

# Global Argus



4 February, 2008

# Mission

**ARGUS provides a global biological event detection and tracking capability that yields actionable early warning alerts**



# History *(continued)*

- During 2005 and 2006, development work continued on IT platforms, software, and analytical taxonomies.
- Funded in mid-June 2006 to field an operational system.
- Began operations in late July, 2006.
- Within one month, achieved global reach with coverage of 195 of 196 US-recognized countries.
- Achieved initial operating capability in late November, 2006.
- Full operational capability was attained in July, 2007, and the final major system was delivered in January 2008.



[illegible]

- Assemble social disruption key word queries from SME-derived Indicators and Warnings (I&Ws).
- Acquire collection and modeling capabilities to capture and analyze articles from the World Wide Web.
- Develop and implement an automated cueing and alerting capability.

# What We Don't Do

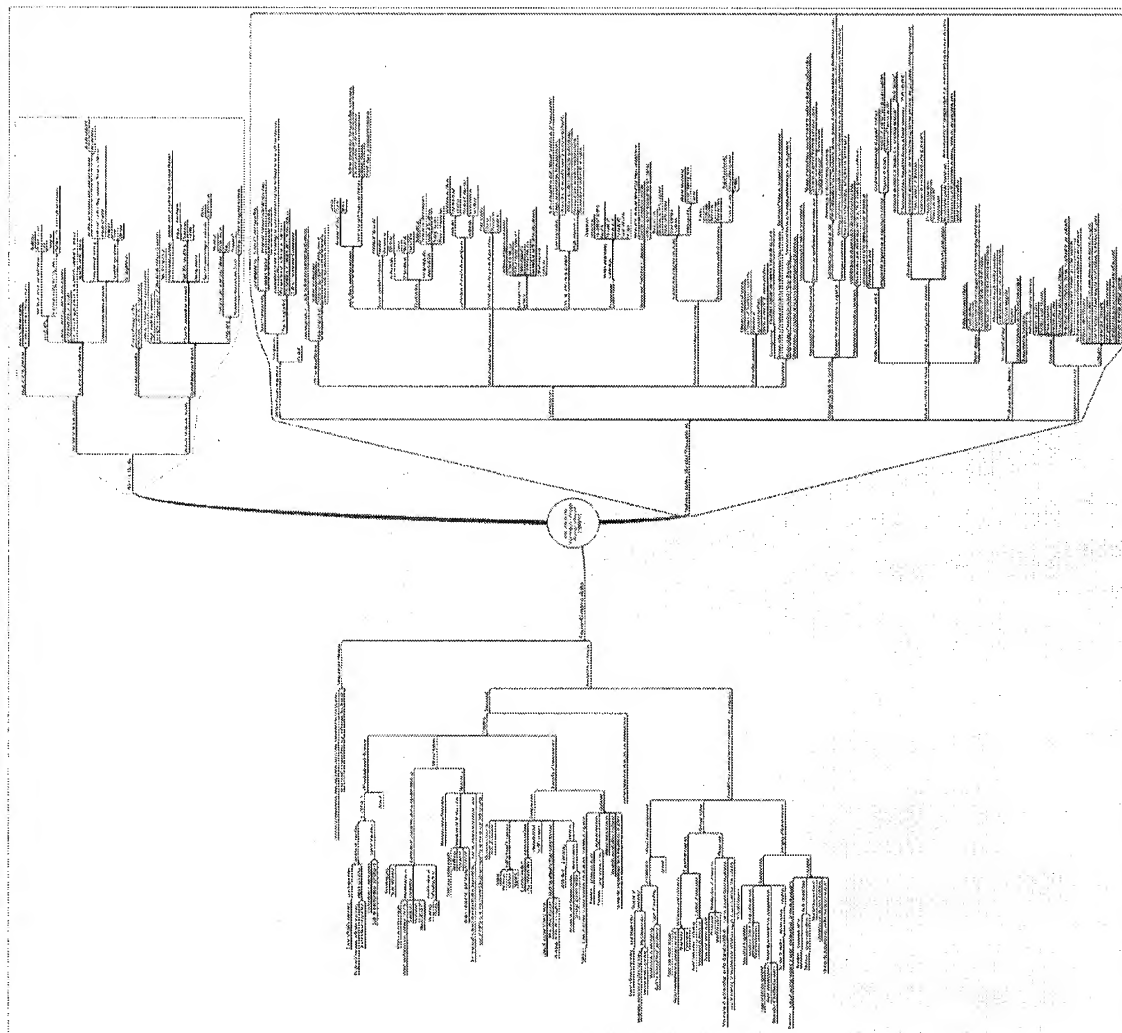
- Ground truthing
- Pathogen diagnostics

**Argus is a cueing and alerting capability that complements the long established public health and attribution investigation approaches used by other organizations.**

# ARGUS is a Radar for Social Disruption

- Epidemics cause social disruption.
- Social disruption is a common feature that can be tracked and used in lieu of direct reporting of disease:
  - Direct Markers
    - Unusual disease reported
  - Indirect Markers
    - Demand for medical services
    - Local perception of threat
    - Official acknowledgement of threat
    - Official action against threat
    - Integrity of infrastructure

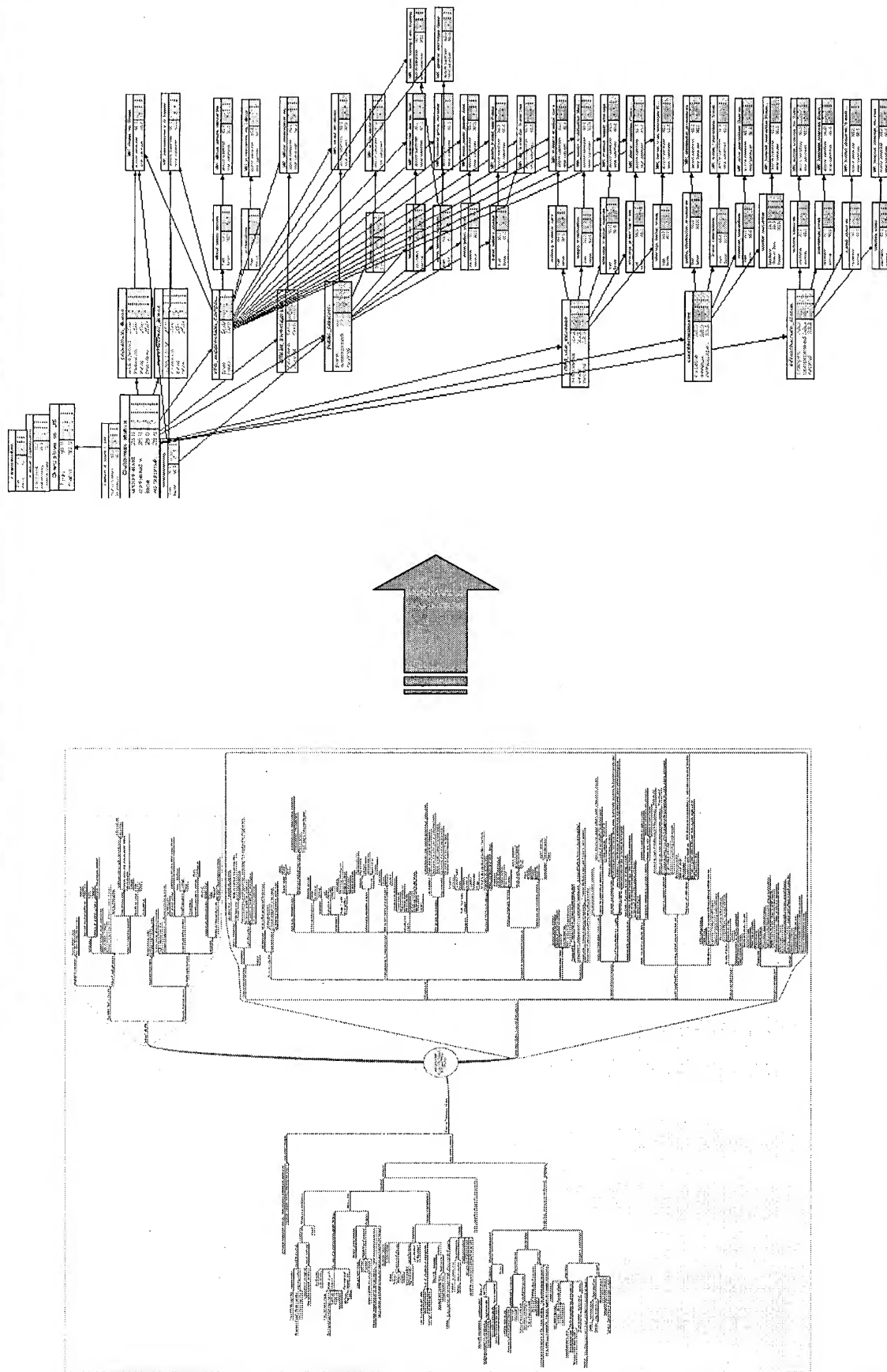
# *I&W Concept Map*



- **Sources:**
  - **Media articles (local sources are key)**
  - **Telecommunication data**
  - **Satellite imagery**
  - **Air transportation data**
- **Scanning Power:**
  - **Over 9,000 scripted sources (~300/month added)**
  - **1 million articles/day accessed with over 250,000/day archived**
  - **Analysts (36) are collectively fluent in 36 foreign languages**
  - **Operating in 195 of 196 US-recognized countries**
  - **Machine Translation: four engine and 14 languages**
  - **111 million articles in archive (Baselines back 5 years)**
  - **Bayesian analyses for article selection, alerting and decision analysis (23 area models in 11 languages)**
  - **Over 2000 active case files with 190 added/day; Filed 50,000 reports since inception; projecting 40-50,000 reports/yr**

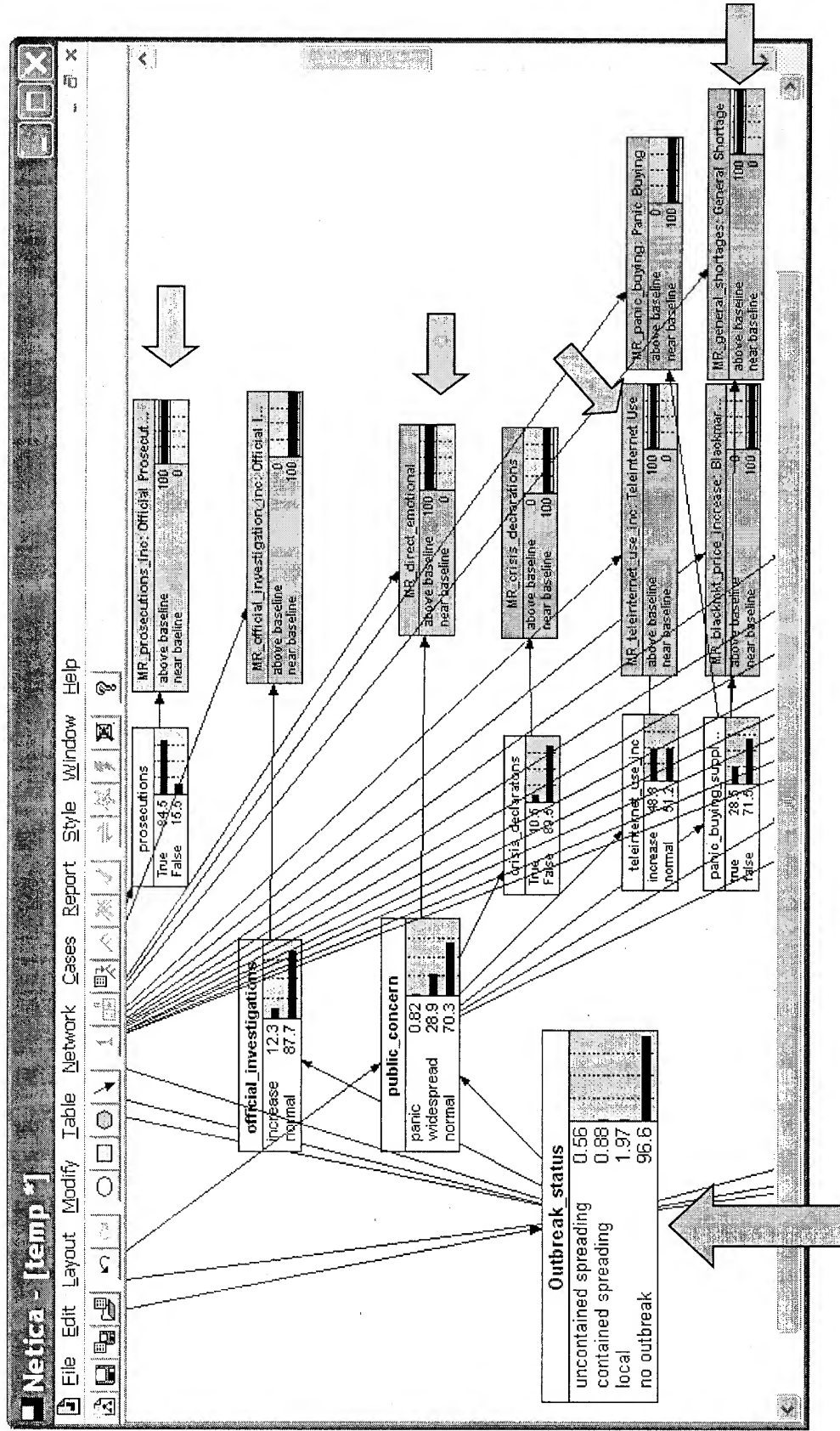
# ARGUS Alerting Algorithm:

## Translation of the I&W Concept Map into a Bayesian Causal Model



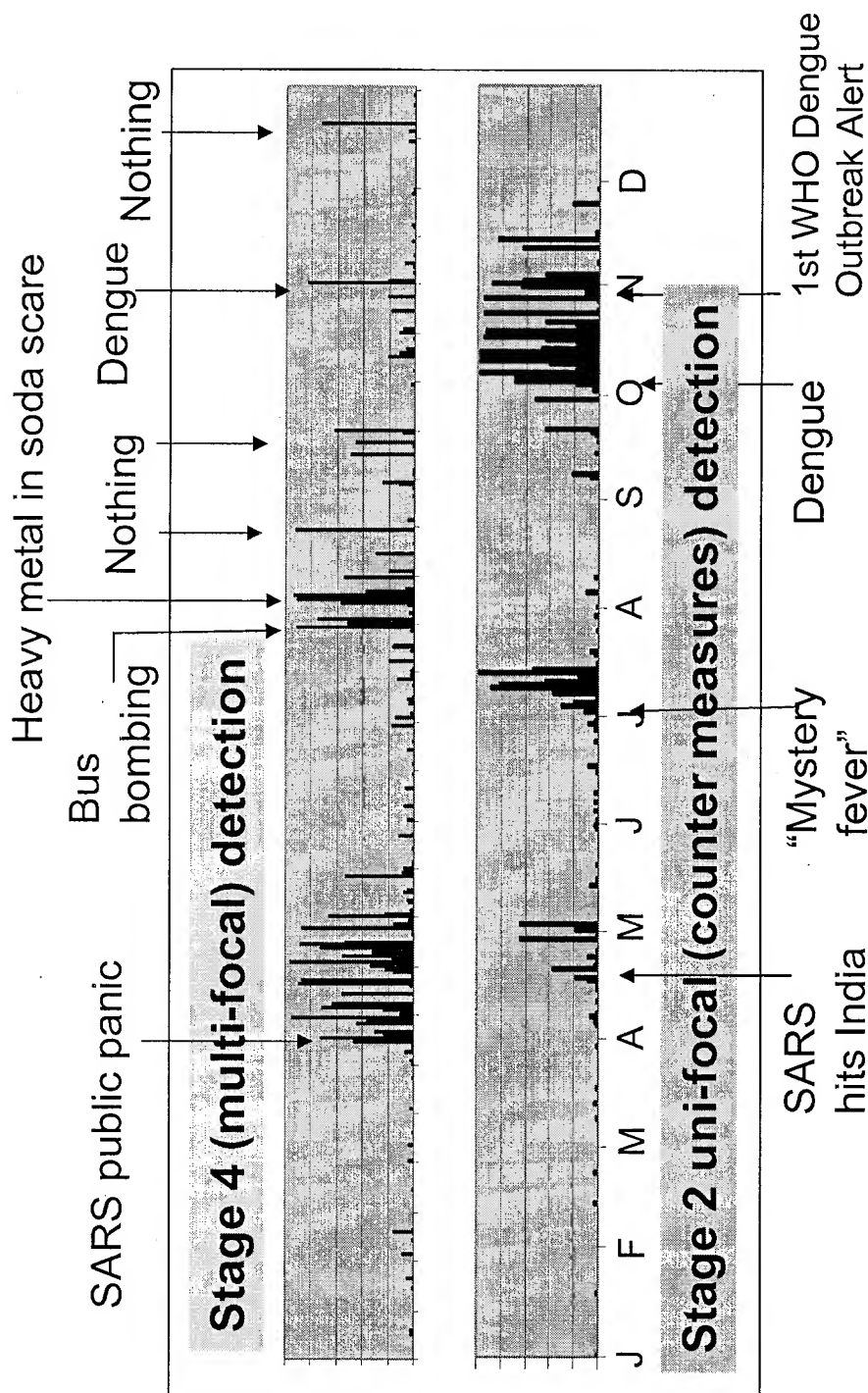


# Prototype: Bayesian Network with Evidence Values Set from Article Frequency Counts



Estimate “probability” of uncontained outbreak

# Bayesian Models of Early Outbreak Detection (Stage 2) vs. Late Outbreak Social Disruption Detection (Stage 4)



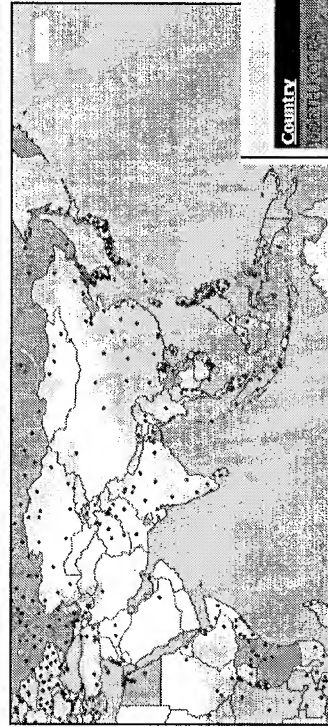
# Watchboard – Sample Screenshot



Argus Watchboard™

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- Argus Watchboard Biological Event World Map -



Levels

Warning

Watch

Advisory

2007-02-23 17:53:03

Argus Research Operations Center (AROC), Washington DC

The data information is classified in accordance with the ITIC policy. This information is for internal use only and is not to be released to the public. The information is for internal use only and is not to be released to the public. The information is for internal use only and is not to be released to the public.

**Suspects**  
Biological A

Country: ITALY

Source Overview: National

Specific Location: Liguria

National media have reported that six people are currently undergoing CBRN (chemical, biological, radiological, nuclear) testing at the offices of Bogliasso. The powder, which was found in an envelope, is currently being tested; anthrax is

[Senior Analyst Note]

This report suggests the possibility that anthrax has been used as a biological weapon, similar to the attack in October, 2006. The previous two 'suspicious powders' were found not to be anthrax.

Currently, over 2000 active, socially disruptive biological events tracked in over 170 countries in near-real time.

## - Biological Event Country Reports -

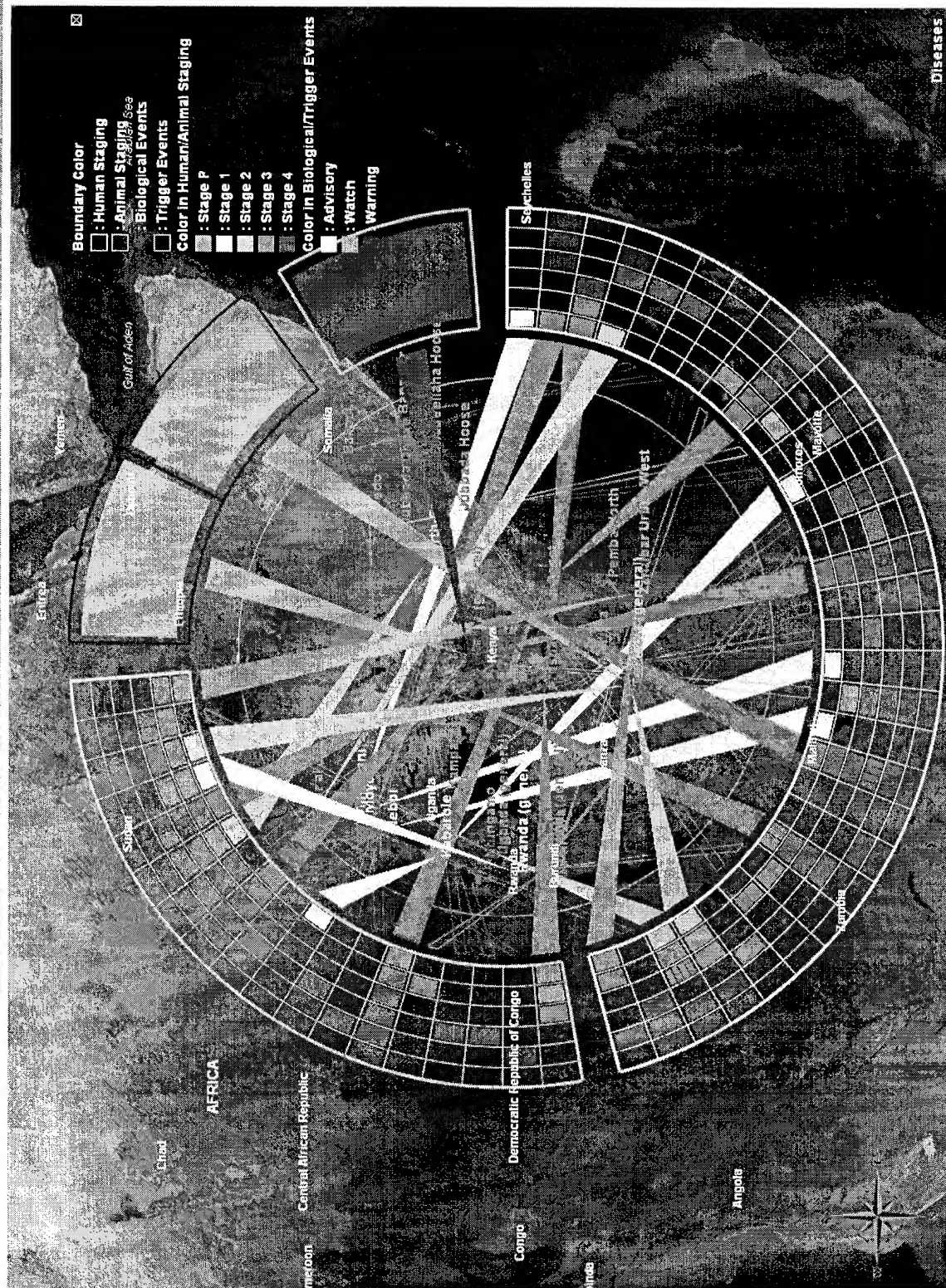
Country	Title	Date
AFGHANISTAN	Measles, Typhoid, Paratyphoid, Cholera, Meningococcal Fever	2/23/2007
AFGHANISTAN	Slippery Slope	2/23/2007
CANADA	Respiratory Disease, Bird Die-Off	2/23/2007
RUSSIA	H5N1 Avian Influenza, Respiratory Disease	2/24/2007
EGYPT	H5N1 Avian Influenza	2/24/2007
EGYPT	Rift Valley Fever	2/24/2007
KENYA	Rift Valley Fever	2/24/2007
LAOS	H5N1 Avian Influenza	2/25/2007
INDIA	H5N1 Avian Influenza	2/23/2007
NIGERIA	H5N1 Avian Influenza	2/24/2007
TURKEY	H5N1 Avian Influenza	2/24/2007
MEXICO	Respiratory Disease	2/24/2007
AFGHANISTAN	H5N1 Avian Influenza	2/24/2007
AFGHANISTAN	H5N1 Avian Influenza, Polio	2/24/2007
PAKISTAN	H5N1 Avian Influenza	2/25/2007
KUWAIT	H5N1 Avian Influenza	2/25/2007
BANGLADESH	Undiagnosed Human Disease	2/25/2007
SPAIN	Respiratory Disease	2/23/2007
JAPAN	Respiratory Disease	2/23/2007
HONG KONG	H5N1 Avian Influenza, Undiagnosed Equine Disease	2/23/2007
INDONESIA	H5N1 Avian Influenza	2/23/2007
UKRAINE	Respiratory Disease	2/23/2007
PAPUA NEW GUINEA	Undiagnosed Disease (Human, Porcine)	2/23/2007
NORWAY	Respiratory Disease	2/23/2007
CHINA	SARS: Increased Prevention	2/23/2007

- Colors represent different levels of action required: [Yellow: Advisory] [Orange: Watch] [Red: Alert]

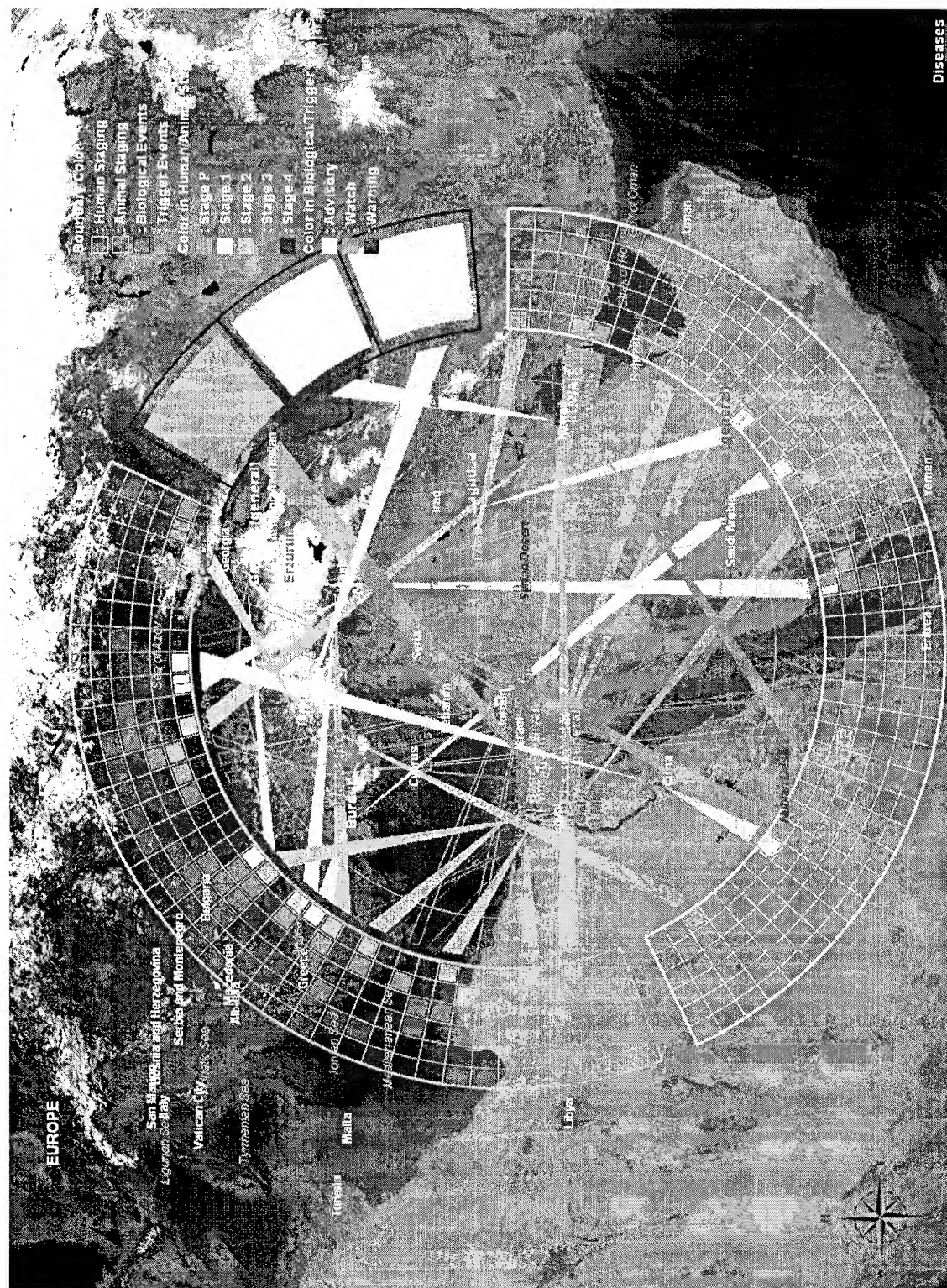
- Bold indicates Reports issued within 24 hrs.



# Argus Common Operating Picture

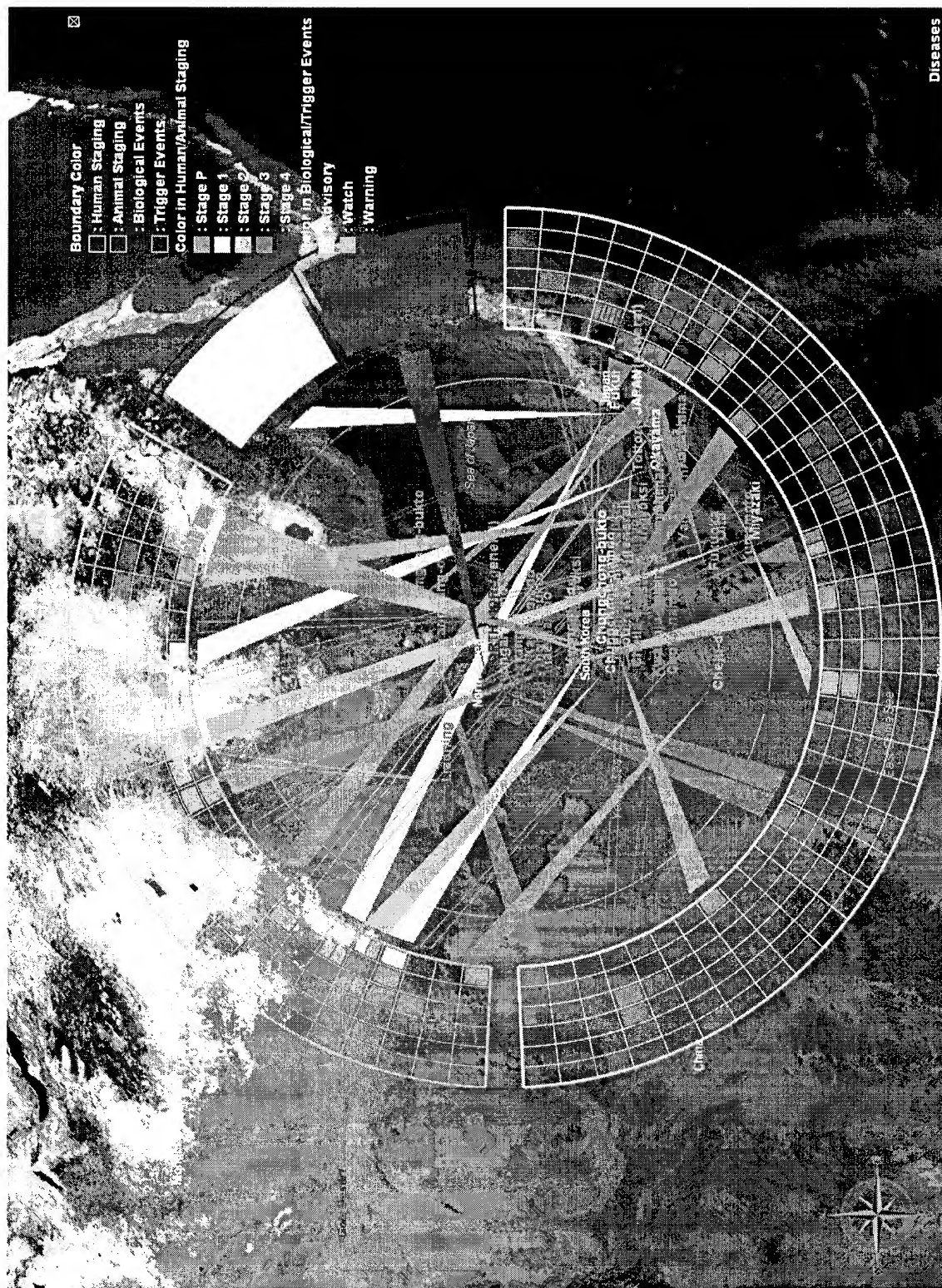


# Argus Common Operating Picture





# Argus Common Operating Picture



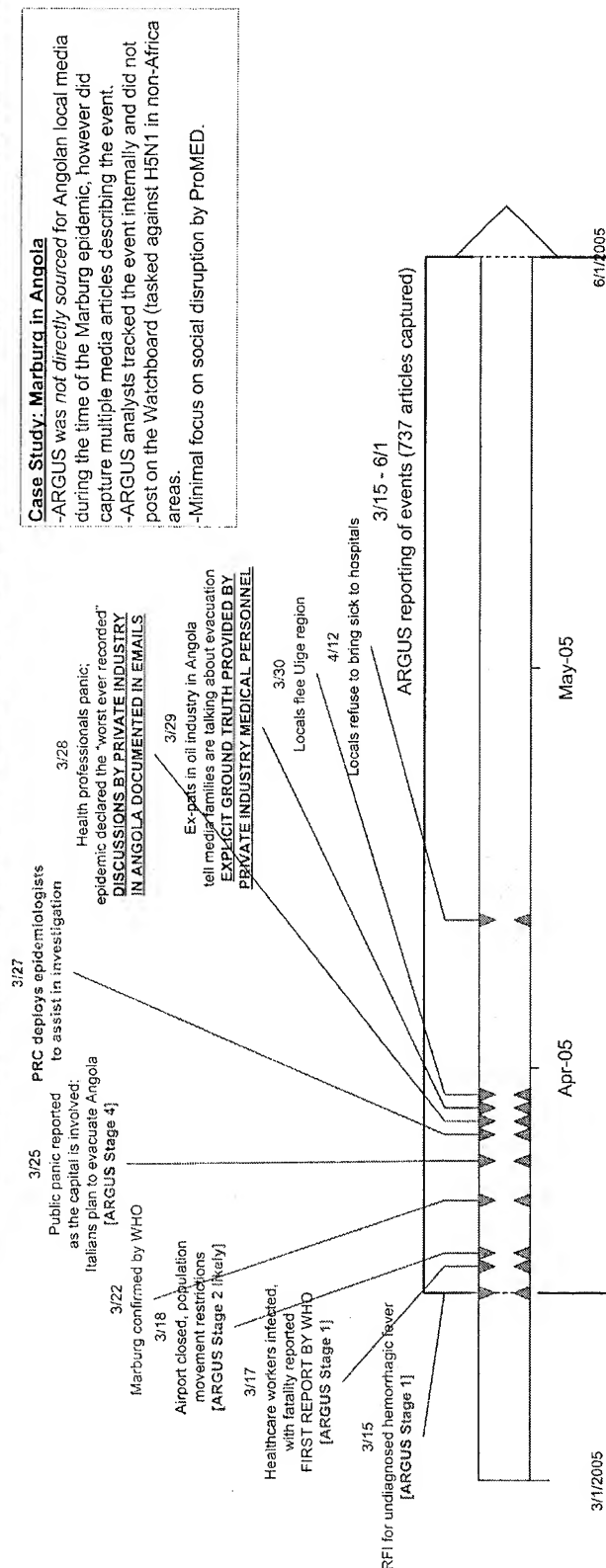


# Argus Case Study

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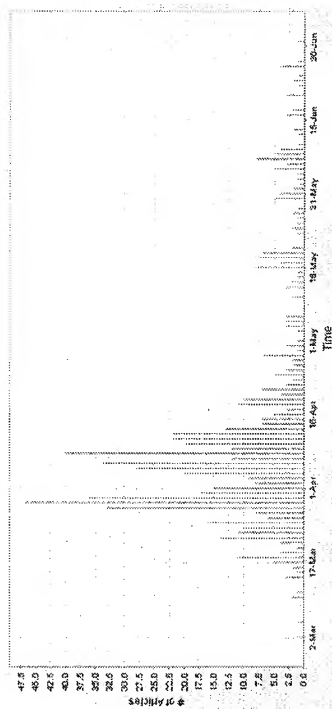
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ProMED Reports= 50 (~ 8% of total available information)  
WHO Reports= 7 (~1% of total available information)

***Time to perform study: 3 days***

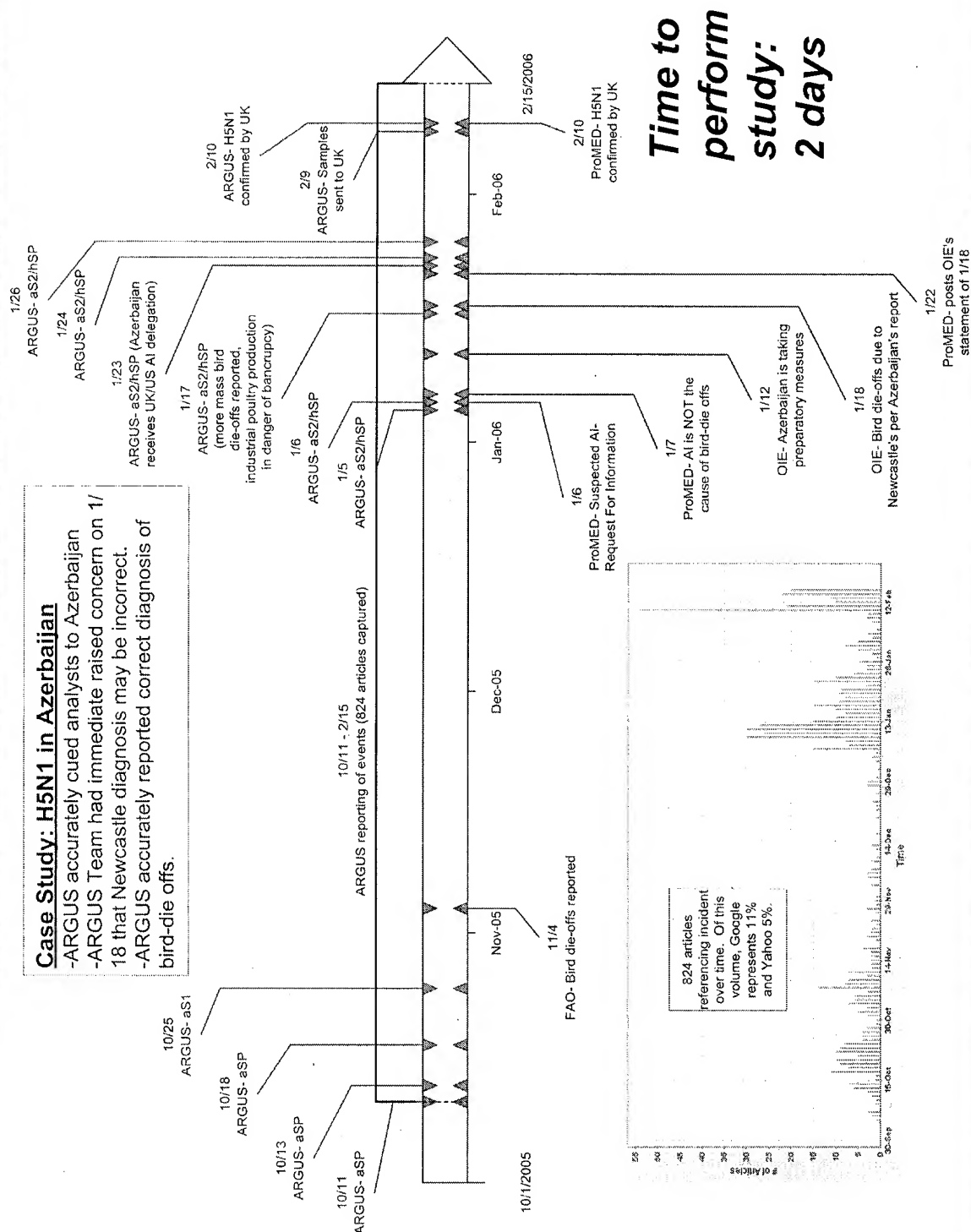


ARGUS WATCHBOARD  
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University

# Argus Case Study

## Case Study: H5N1 in Azerbaijan

- ARGUS accurately cued analysts to Azerbaijan  
 ARGUS Team had immediate raised concern on 1/  
 18 that Newcastle diagnosis may be incorrect.  
 ARGUS accurately reported correct diagnosis of  
 bird-die offs.

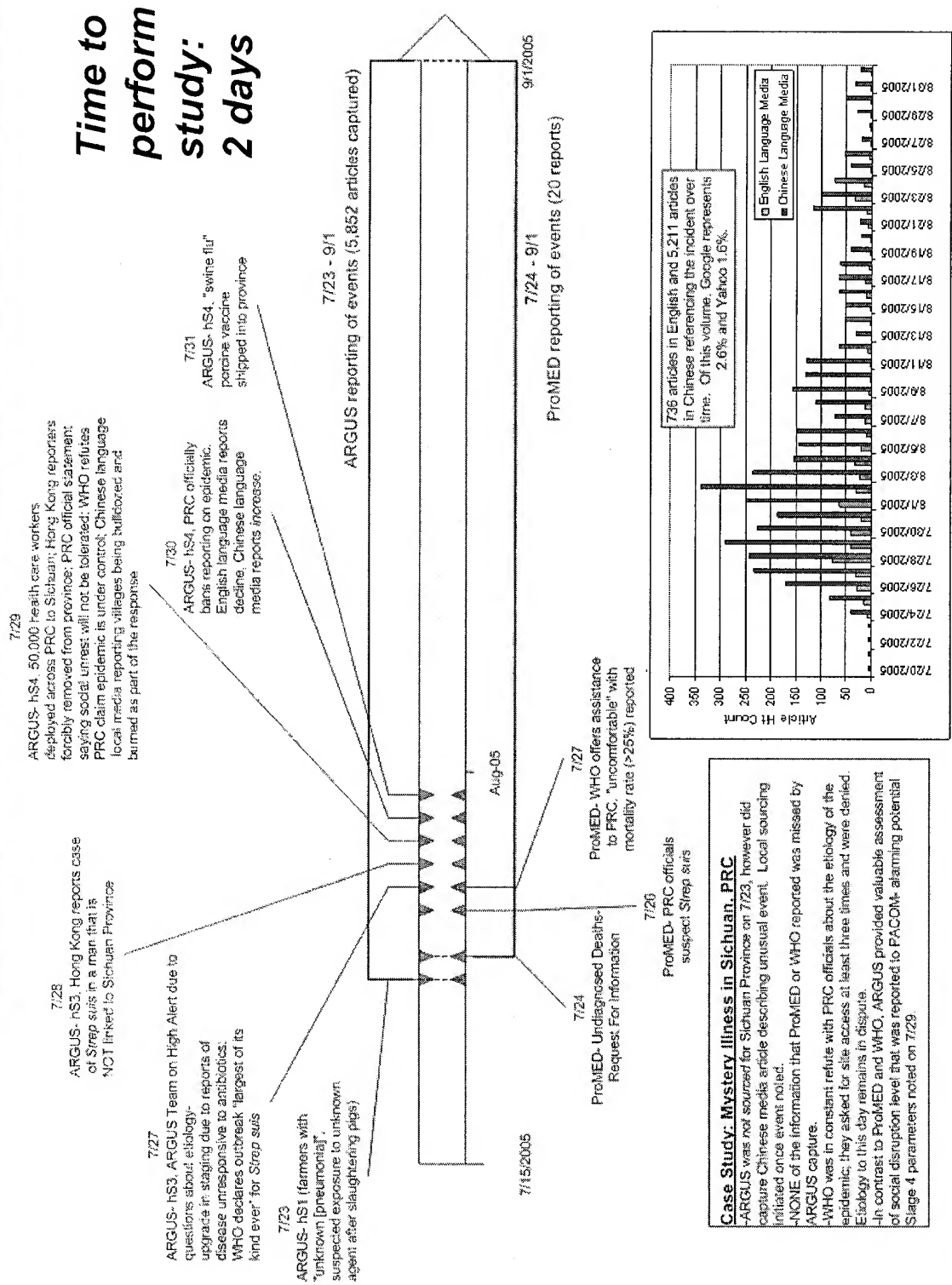


***Time to perform study: 2 days***

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Intelligence Technology Innovation Center  
**ITIC**

# Argus Case Study



**Case Study: Mystery Illness in Sichuan, PRC**

ARGUS was not sourced for Sichuan Province on 7/23, however did capture Chinese media article describing unusual event. Local sourcing initiated once event noted.

NONE of the information that PromED or WHO reported was missed by ARGUS capture.

WHO was in constant refute with PRC officials about the etiology of the epidemic; they asked for site access at least three times and were denied.

Etiology to this day remains in dispute.

In contrast to PromED and WHO, ARGUS provided valuable assessment of social disruption level that was reported to PACOM- alarming potential Stage 4 parameters noted on 7/29.

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# Summary

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- Argus is changing the expectations for bioevent detection.
- The system has been reduced to practice on a global scale. Actively tracking avian influenza and 130 other infectious diseases.
- Reports sent to over 300 accounts (many with multiple users) in approximately 200 organizations.
- The Argus process can have much broader application in event tracking of other issues.

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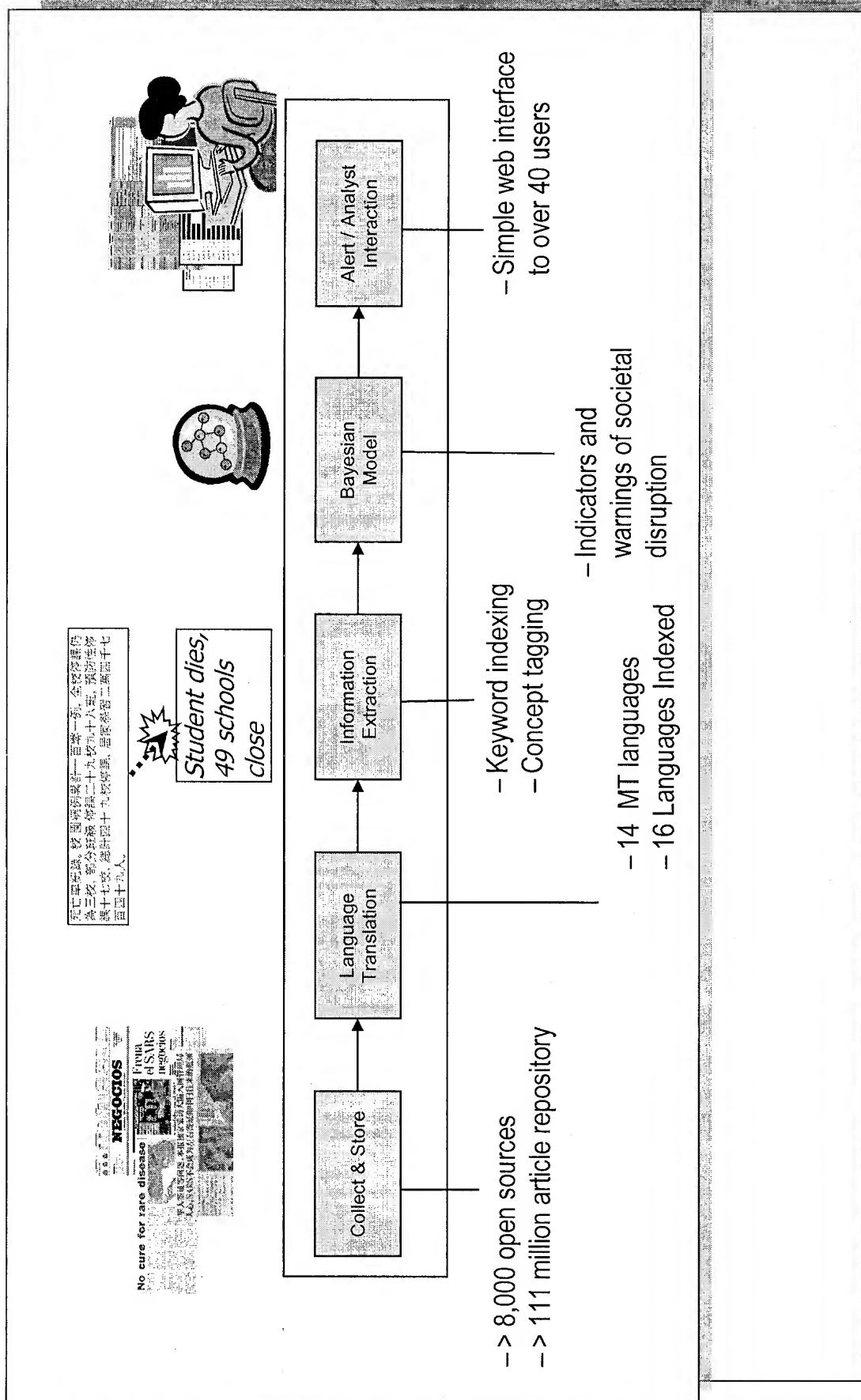


# BACKUP FIGURES

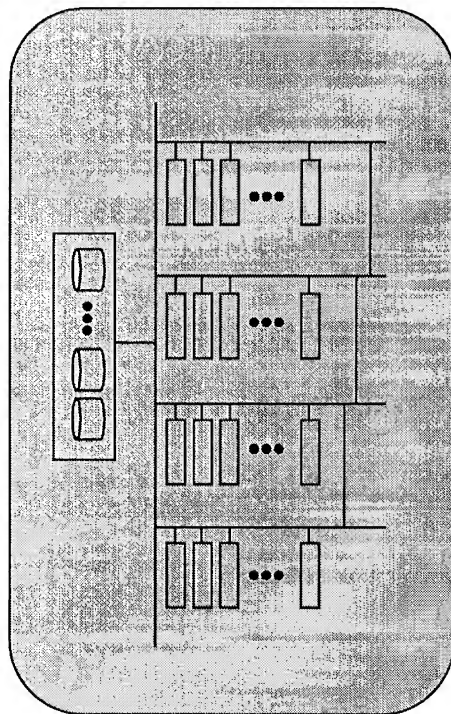
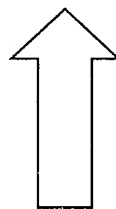
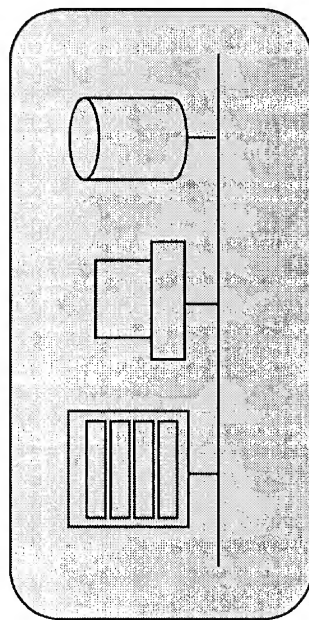
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# Argus Concept



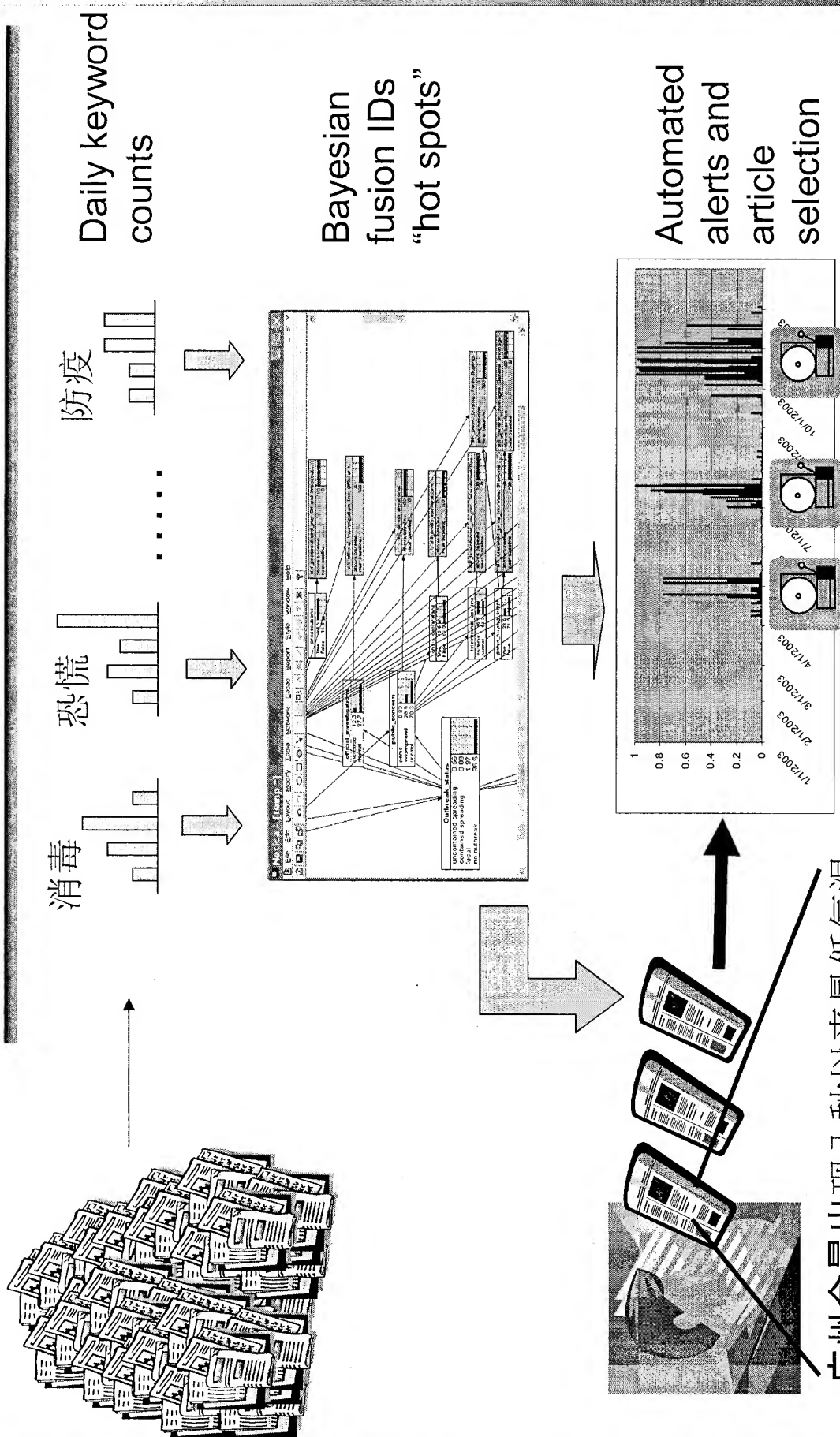
# AGIS to APOLLO Transition



- < 8 Servers, 1 cluster
- 1 network
- Network file system storage
- Basic job control
- Basic indexing architecture

- > 30 Servers, multiple clusters
- > 4 networks
- Cluster file storage
- Advanced COTS middleware for document processing job control
- Highly optimized distributed indexing architecture
- Highly optimized query support architecture
- System status monitoring

# High-Level Modeling Concept



广州今晨出现入秋以来最低气温  
20% increase in emergency patients

# Argus Document Processing Rates

System	Documents Per Day	Basis
isisMiTAP	25,000 to 75,000	Actual
Argus Global Information System (AGIS)	75,000 to 175,000	Actual
Apollo instance at GU at Phase 2 (Jan 2008)	390,000 to 975,000	Estimated from Performance Engineering Models and lab tests
Apollo architecture at full capacity	3,900,000 to 9,750,000	Extrapolated Estimate from Performance Engineering Models Using Additional Servers